

LISTING OF THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A sternal closure system for reapproximating left and right halves of a patient's longitudinally incised sternum during a surgical procedure in the thoracic cavity, the system comprising:

a first, at least one anchor means having an inner axial passage, adapted to be disposed inside the left half of the sternum;

a second, at least one anchor means having an inner axial passage, adapted to be disposed inside the right half of the sternum; and

at least one rigid fixing means having two legs, each adapted for insertion in a respective one of said axial passages, to rigidly connect said first, at least one anchor means, disposed within the left half of the sternum, to said second, at least one anchor means disposed within the right half of the sternum, the rigid fixing means adapted to externally extend across an incision of the incised sternum between first and second anchor means and being removably tightly held by the first and second anchor means as a non-attached member separate from the first and second anchor means, the rigid fixing means adapted to maintain the left half of the sternum and the right half of the sternum in relative position for reapproximation, so as to facilitate separation of the left and right halves of the sternum when necessary,

the legs of said rigid fixing means being adapted for subsequent extraction from the respective axial passages so as to facilitate separation of the left and right halves of the sternum when necessary, and for re-insertion therein.

2. (Previously Presented) A system according to claim 1, wherein said first, at least one anchor means, adapted to be disposed within the left half of the sternum, and said second, at least one anchor means, adapted to be disposed within the right half of the sternum, are screws having an external thread of one direction.

3. (Previously Presented) A system according to claim 1, wherein said first, at least one anchor means, adapted to be disposed within the left half of the sternum, and said

second, at least one anchor means, adapted to be disposed within the right half of the sternum, are screws having an external thread of different directions.

4. (Previously Presented) A system according to claim 1, wherein said first, at least one anchor means, adapted to be disposed within the left half of the sternum, and said second, at least one anchor means, adapted to be disposed within the right half of the sternum, have heads provided with means for grasping and rotating them by said apparatus for simultaneous placing of said anchor means.

5. (Previously Presented) A system according to claim 4, wherein the heads of said first and said second anchor means are provided with means for their grasping by said apparatus for simultaneously placing said anchor means, said grasping means being generally shaped as grooves on the side surface of said heads.

6. (Previously Presented) A system according to claim 4, wherein the heads of said first and said second anchor means are provided with means for their rotation by said apparatus for simultaneously placing said anchor means, and these means for their rotation are generally cross-shaped slots on the end surface of said heads.

7. (Original) A system according to claim 4, wherein the heads of said first and said second anchor means are provided with means for their rotation by said apparatus for simultaneous placing of said anchor means, and these means for rotation are substantially shaped as hexahedral holes in the end face of said heads.

8. (Previously Presented) A system according to claim 1, wherein said at least one fixing means is substantially shaped as a staple having a body and at least two legs extending from the body in a substantially perpendicular relationship, whereby said staple is adapted for rigidly connecting said first, at least one anchor means, to said second, at least one anchor means.

9. (Canceled)

10. (Previously Presented) A system according to claim 8, wherein said at least one fixing means is formed as a staple having a curved body and at least two slightly curved legs for tightly disposing in a respective inner axial passage of said first, at least one anchor means adapted to be disposed in the left half of the sternum, and said second, at least one anchor means adapted to be disposed in the right half of the sternum.

11. (Previously Presented) A system according to claim 1, wherein said first, at least one anchor means, adapted to be disposed within the left half of the sternum, said second, at least one anchor means, adapted to be disposed within the right half of the sternum, and said at least one fixing means, are all made of FDA approved metal or alloy, mainly of one of metal or alloy of the group, consisting of stainless steel, titanium, tantalum, alloys of titanium and tantalum.

12. (Previously Presented) A system according to claim 1, wherein said first, at least one anchor means, adapted to be disposed within the left half of the sternum, said second, at least one anchor means, adapted to be disposed within the right half of the sternum, and said at least one fixing means, are all made from FDA approved biodegradable material.

13. (Previously Presented) A system according to claim 1, further comprising an apparatus for simultaneously placing in the sternum first, at least one anchor means, adapted to be disposed within the left half of the sternum and said second, at least one anchor means adapted to be disposed within the right half of the sternum, said apparatus comprising:

a power means to generate a torque;

a means for transmitting torque simultaneously to said first and said second anchor means;

a means for searching and grasping simultaneously said first and said second anchor means; and

a means for retaining and simultaneously delivering said first and said second anchor means to said means for their searching and grasping.

14. (Previously Presented) A system according to claim 13, wherein said power means for generating a torque comprises one of the means of a group including an electric, pneumatic or hydraulic engine.

15. (Previously Presented) A system according to claim 13, wherein said means for transmitting torque simultaneously to said first and said second anchor means is generally a gear box having one drive shaft and at least two driven shafts.

16. (Previously Presented) A system according to claim 15, wherein on the driven shafts of said gear box there are mounted spring-loaded heads forming said means for searching and grasping simultaneously said first and said second anchor means.

17. (Previously Presented) A system according to claim 13, wherein said apparatus for simultaneously placing in the sternum said first, at least one anchor means, adapted to be disposed within the left half of the sternum, and said second, at least one anchor means, adapted to be disposed within the right half of the sternum, comprises a frame means with vertical guides, and said means for retaining and simultaneously delivering said first and said second anchor means to said means for their searching and grasping comprises a spring-loaded cartridge means disposed within said frame means.

18. (Previously Presented) A system according to claim 17 wherein, said means for retaining and simultaneously delivering said first and said second anchor means to said means for their searching and grasping comprises a spring-loaded cartridge means, disposed within said frame means and capable of stepping horizontal movement towards said means for searching and grasping said anchor means.

19. (Previously Presented) A system according to claim 13, wherein said apparatus for simultaneously placing in the sternum said first, at least one anchor means adapted to be disposed within the left half of the sternum, and said second, at least one anchor means adapted to be disposed within the right half of the sternum, contains a frame means with two horizontal

plates disposed in a parallel relationship to each other and at least one vertical guide rigidly connected to at least one of these plates, and said means for retaining and simultaneously delivering said first and said second anchor means to said means for their searching and grasping contains two spring-loaded rotary drums disposed between the plates within said frame means.

20. (Previously Presented) A system according to claim 19, wherein said means for retaining and simultaneously delivering said first and said second anchor means to said means for their searching and grasping contains two spring-loaded rotary drums disposed between the plates within said frame means adapted to perform stepping synchronous swinging about their vertical axes towards said means for searching and grasping said anchor means.

21. (Previously Presented) A system according to claim 13, wherein, in said apparatus for simultaneously placing in the sternum said first, at least one anchor means, adapted to be disposed within the left half of sternum, and said second, at least one anchor means, adapted to be disposed within the right half of sternum, said power means for generating torque, means for transmitting torque simultaneously to said first and said second anchor means, and means for searching and grasping simultaneously said first and said second anchor means, are formed as a single unit disposed on said at least one vertical guide of said frame means reciprocally relative to the latter.

22. (Previously Presented) A system according to claim 1, further comprising a fixing apparatus for placing and removing said fixing means adapted for rigidly securing to one another said first, at least one anchor means, adapted to be disposed within the left half of the sternum and said second, at least one anchor means, adapted to be disposed within the right half of the sternum, wherein the fixing apparatus comprises:

at least first and second levers each having a proximal end and distal end, the levers being pivotally connected to one another and provided with handles at their distal ends and means for grasping heads of anchor means at their proximal ends;

at least one third lever pivotally connected to said first lever or said second lever and provided with a handle at its distal end, and at its proximal end with a means for delivering the fixing means inside said first and said second anchor means, formed substantially as a pusher;

a means for retaining and by the piece delivering of fixing means, formed substantially as a movable spring-loaded die with slots for disposing fixing means.

23. (Previously Presented) A system according to claim 22, wherein said fixing apparatus further comprises at least first and second levers each having a proximal end and a distal end, the first and second levers being pivotally connected to each other, spring-loaded relative to each another and provided with handles at their distal ends, and means for grasping the heads of anchor means at their proximal ends.

24. (Previously Presented) A system according to claim 22, wherein said means for grasping the heads of anchor means are formed as two protrusions facing one another, one of them being disposed at the proximal end of first lever, and the second at the proximal end of second lever, and these protrusions have, at their free ends, recesses matching a shape of grooves on side surfaces of heads of said anchor means.

25. (Previously Presented) A system according to claim 22, wherein said fixing apparatus further comprises at least one third lever pivotally connected to said first lever or said second lever and spring-loaded relative to the first or second levers, said third lever being provided with a handle at its distal end, and at its proximal end with a means for delivering the fixing means inside said first and said second anchor means, which is shaped substantially as a pusher.

26. (Previously Presented) A system according to claim 22, wherein said fixing apparatus has a means for retaining and by the piece delivering of fixing means, comprising generally a movable spring-loaded die with slots for disposing the fixing means, the die being adapted to perform stepping linear movement in a guide, which is rigidly connected to said first lever or to said second lever of said fixing apparatus.

27. (Previously Presented) A system according to claim 1, further comprising a fixing apparatus for placing said fixing means, the fixing apparatus comprising:

at least two levers, the first and the second, each of them having a proximal end and a distal end, the at least two levers being pivotally connected to one another and provided with handles at their distal ends, as well as with means for grasping heads of anchor means at their proximal ends;

at least one third lever pivotally connected to a bearing plate rigidly secured on said first lever or said second lever, the third lever having a handle at its free end, and pivotally connected by its middle to the means for delivering the fixing means inside first and said second anchor means formed substantially as a pusher;

a means for retaining and by the piece delivering of fixing means formed substantially as a cartridge enclosing spring-loaded fixing means located right up to one another.

28. (Original) A system according to claim 27, wherein said fixing apparatus contains at least two levers, the first and the second, each of them having a proximal end and a distal end, these levers are pivotally connected to one another and provided with handles at their distal ends, means for mutually fixing the handles when brought together, as well as by means for grasping the heads of anchor means at their proximal ends.

29. (Previously Presented) A system according to claim 28, wherein said means for grasping the heads of anchor means are configured as two protrusions facing one another, one of which is disposed at the proximal end of the first lever, and the second at the proximal end of the second lever, and the protrusions having at their free ends recesses matching a shape of grooves on side surfaces of the heads of said anchor means.

30. (Original) A system according to claim 27, wherein said fixing apparatus contains a single unit including at least one third lever, a means for retaining and by the piece delivery of fixing means formed substantially as a cartridge, and a means for delivering a fixing means inside said first and said second anchor means formed substantially as a pusher, this single

unit is pivotally connected to the bearing plate rigidly mounted on said first lever or said second lever and is capable of folding back in the vertical plane to provide viewing of said means for grasping the anchor means or returning into operative position with simultaneous rigid fixing of the cartridge at the proximal ends of said first and second levers of the fixing apparatus.

31. (Previously Presented) A system according to claim 1, further comprising an apparatus for removing said fixing means when it is necessary to perform a post-operative surgical procedure within the thoracic cavity, the apparatus for removing comprising:

a hollow body provided with a handle extending therefrom, and in its lower part, a bifurcated stop;

a spring-loaded grasping member movably disposed within the hollow body; and

a pressure lever pivotally mounted on a pin within the upper part of the hollow body, the pressure lever having a handle extending substantially in the same direction as said handle of the hollow body and a free end located within the hollow body and operatively connected to said spring-loaded grasping member.

32. (Canceled)

33. (Previously Presented) A system according to claim 1, further comprising an apparatus for simultaneously placing in the sternum said first, at least one anchor means, adapted for disposing within the left half of the sternum, and said second, at least one anchor means, adapted to be disposed within the right half of the sternum.

34. (Previously Presented) A system according to claim 1, further comprising a fixing apparatus for placing said fixing means adapted for rigidly and releasably connecting said first, at least one anchor means, adapted to be disposed within the left half of the sternum and said second, at least one anchor means, adapted to be disposed within the right half of the sternum, whereby there is performed a rigid connection to one another of the left and the right halves of the sternum during a surgical procedure within the thoracic cavity.

35. (Previously Presented) A system according to claim 1, further comprising an apparatus for removing said fixing means when it is necessary to perform a post-operative surgical procedure in the thoracic cavity, facilitating separation of the left and right halves of sternum closed in this way, in case of post-operative emergency surgical procedures.

36. (Currently Amended-) A sternal closure system for maintaining left and right halves of a patient's longitudinally incised sternum in proper spaced relationship during a surgical procedure in the thoracic cavity, the system comprising:

a first anchor having an inner axial passage, adapted to be disposed within the left half of the sternum;

a second anchor having an inner axial passage, adapted to be disposed within the right half of the sternum; and

a rigid fastener having two legs each being adapted for repeated insertion into and withdrawal from a respective one of said inner axial passages when the first anchor and the second anchor are disposed within respective halves of the sternum, the rigid fastener adapted to externally extend across an incision of the incised sternum between the first anchor and second anchor and being removably tightly held as a non-attached member separate from the first anchor and second anchor, the rigid fastener adapted to maintain the left half of the sternum and the right half of the sternum in relative position for reapproximation.